PV FED CAPACITOR BALANCING MULTILEVEL INVERTER

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Abstract—In this project deals with the power generation using a new renewable energy source and different method of generation, which is comprised of a dc/dc converter and a new 13-level inverter. This 13 level multi-level inverter was constructing using a full-bridge power converter and a CSC. The step level of dc power into ac power getting from H-bridge inverter converts. From this PV power generation inverter produce a sinusoidal output power and reduced THD was reduced. The main advantage of this inverter is only eleven power electronics are used. MATLAB is used to develop this prototype and performance of this system tested and verify.

Keywords: Photo-Voltaic (PV) module, Capacitor selection circuit (CSC), Total Harmonic Distortion (THD), Amplitude (Amp), Multi-Level Inverter (MLI).

1.1INTRODUCTION

This project explains about principle operation of multilevel inverter. The principle of the inverter is converting the dc power into ac power. During conversion of this dc power into ac power the output waveform consists of higher level of THD and the output waveform is not sinusoidal. With the help of the power electronics switches (MOSFET) which means multilevel inverter is used to reduce the THD level and improved sinusoidal waveform can be obtained. The application
of the non-renewable energy source (conventional power generation) using in various applications. But day by day the amounts of conventional sources are reducing for increasing power demand. So after two or three decades we will face lot of power problems. But we can bridge this power problem using the renewable energy power generation instead of conventional energy. Now a day the amount of power user’s level increased. The main application of renewable energy system is monotonically increasing cost of panels is decreasing and the higher reliability, very low gas emission compared to non-renewable energy system. The cost of solar array is reducing by day by new inventions. Some of the consideration required for the pooling of non-conventional energy sources to utility grid i.e. voltage value, matching of frequency, voltage stability and economical aspects. These are all the big challenges while pooling non-conventional source of energy with power grid. The power consolidation is very important for utility grid pooled PV energy system. Because of it is used to get DC power under the Photovoltaic effect, here low waste of energy developed or its generates from solar energy sources.

1.2 MATERIALS AND METHODOLOGY
This project consist of nine power electronic switches and THD can be reduced from existing system .THD of this proposed system is 9.36%. The output waveform level is increased from existing system and obtained level is 13. When number of switches increases power loss will be more. But in the proposed system will reduce THD level compare with existing system. The figure 1.2 is the simulink diagram the figure 1.2 which was designed using Matlab/simulink is used to design the similar diagram. MOSFET power electronics switches are sed here.the circuit is designed by using components of Simulink and Sim-power system. Different switching frequencies are used in the dc to dc converter circuit, CSC and VSI i.e. 10 KHz, 100 Hz, 20Hz and 20KHz. PV panel is design requires Single diode model. Scope is used to show the graphical output view. Gate pulses provided to the transistor switches with the help of Pulse generator and PWM generator block.
1.2. 1 OPERATION MODES

The table 1.1 illustrates switching states in 13 Level inverter. That table 1.1 to explain the mode operation for multi level converter.

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_L=V_H/3</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V_L=V_H/5</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V_L=V_H/7</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>V_H=V_H</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Table 1.1: Switching Sate of Positive Cycle Operation

To provide the gate pulses for the transistor switches are used in Pulse generator and PWM generator blocks.

1.3 SIMULATION RESULTS AND DISCUSSION

This system model consists of nine switches and we can obtain 13 levels. THD will be reduced about 9.8%. The figure 1.2 is the simulink diagram of dc to dc converter. The using of CSC, VSI& and DC to DC Converter with different switching frequencies i.e. 20 kHz, 200 Hz, and 40 kHz respectively.

![Fig.1.2 simulation circuit](image)

The figure 1.3 explains to the 5 level dc voltages. In X axis to shows the output.

![Fig.1.3. Output voltage for CSC](image)
The voltage of the 13-level inverter has eleven level of voltage in peak to peak and Y-axis to represents time period and amplitude of voltage. The 440V is maximum value of output voltage.

Fig. 1.4. Amplitude of current waveform

The figure 1.6 shows to converts the 5 level DC current into 13-level AC current. Here the 0.45A magnitude of AC current.

Fig. 1.5. Amp Gate signal waveform

Fig. 1.6. THD of 13 Level Inverter.
Table 1.2 THD in Three Multi Level Inverters

<table>
<thead>
<tr>
<th>MULTILEVEL INVERTERS</th>
<th>THD [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seven Level Inverter</td>
<td>10.66</td>
</tr>
<tr>
<td>Nine Level Inverter</td>
<td>11.40</td>
</tr>
<tr>
<td>Eleven Level Inverter</td>
<td>11.40</td>
</tr>
<tr>
<td>Thirteen Level Inverter</td>
<td>9.50</td>
</tr>
</tbody>
</table>

1.4 HARDWARE

CONCLUSION

In this project to propose the PV fed 13 Level CSC using MLI. THD was presented only 9.8% it is to produce sinusoidal waveform and power also produced from in this inverter. In this system the grid connection was not yet critical. By comparing to three MLI and 13 Level inverter is the 13 Level inverter its harmonic distortion is low. Only the nine transistor switches are require to generate the 13 Level output Voltage and Current. So in this system efficiency is improved, the circuit having simple design and less switching losses.

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